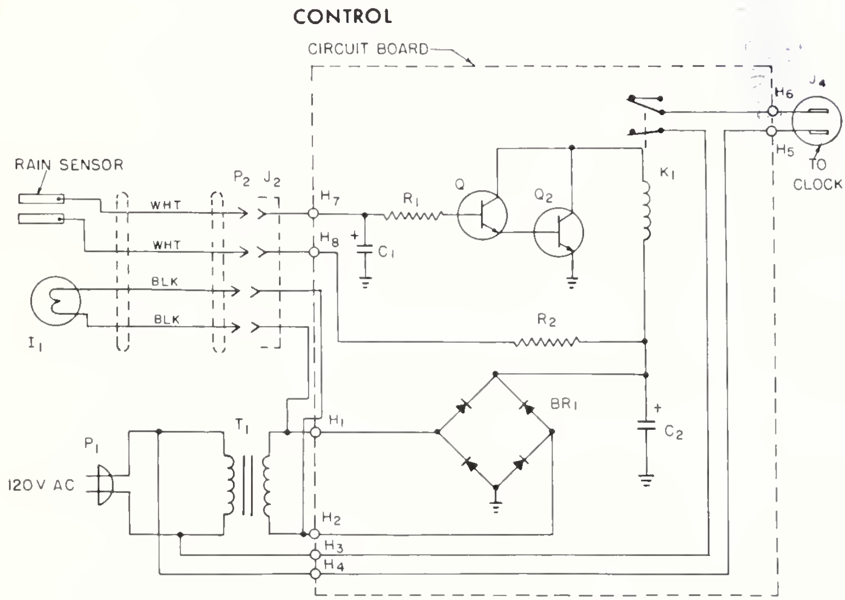
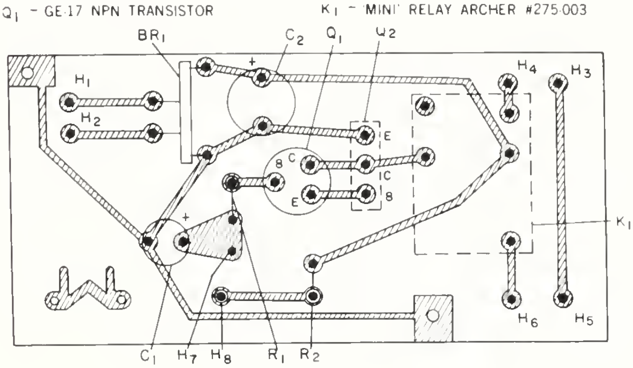
FIRE MANAGEMENT NOTES

SUMMER 1976 Volume 37, Number 3
U.S. DEPARTMENT OF AGRICULTURE • FOREST SERVICE



C1 – 100 uF @ 35 V ELECTROLYTIC
C2 – 500 uF @ 35 V ELECTROLYTIC
R1 – 10 K ½ WATT 10%
R2 – 1 K ½ WATT 10%
Q1 – GE-17 NPN TRANSISTOR
Q2 – GE-66 NPN TRANSISTOR
I1 – 12 V AUTO BULB #67
BR1 – BRIDGE RECTIFIER 1 A 50 PIV
T1 – 12.6 V FILAMENT TRANSFORMER
K1 – 'MINI' RELAY ARCHER #275-003



FOIL SIDE

FIRE MANAGEMENT NOTES

An international quarterly periodical devoted to forest fire management

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Cover Story: NEW EQUIPMENT

For nearly 40 years articles describing new fire equipment have regularly appeared in this periodical. Some of this equipment has been developed at equipment development centers through specially-funded projects. Some has been developed at experiment stations, and some has been developed in the field by the user. Users' needs spawn ideas. From these ideas come inventions, modifications of existing equipment, new uses for existing equipment, new techniques, new technology.

Some of these new developments are publicized through the pages of this periodical. Others, however, are not because of a host of reasons—the prime one being that no one took time to submit it to the Editor for publication. As a result of not sharing our ideas, we often find ourselves "reinventing the wheel." Take a few minutes to share your ideas and your developments with your neighbors in the Fire Management Community. These few minutes may save tax dollars, reduce resource losses, and even save lives.

The Editor

FIRE MANAGEMENT NOTES is issued by the Forest Service of the United States Department of Agriculture, Washington, D.C. The Secretary of Agriculture has determined that the publication of this periodical is necessary in the transaction of the public business required by law of this Department. Use of funds for printing this periodical has been approved by the Director of the Office of Management and Budget through September 30, 1978.

Subscriptions may be obtained from the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402. The subscription rate is $3.00 per year domestic or $3.75 per year foreign. Postage stamps cannot be accepted in payment.

Physical Fitness—What Can Be Done About It?

James A. Dukes

Very few fire management programs in the Forest Service have ever generated as much discussion as firefighter physical fitness. In 1975, after several years of optional use, a set of mandatory physical fitness standards were adopted for Forest Service firefighters.

Physical Fitness Test

Physical fitness is determined by a physical fitness test which consists of a 5-minute step test or a 1½-mile run. The step test is most commonly used, because it is sub-maximal. The 1½-mile run requires a maximum amount of exertion. A physical examination, including a stress electrocardiogram in the case of those 35 years old and over, is required before taking the running test.

The step test measures a person's aerobic capacity by correlating post-exercise pulse rate, age, and weight. The exercise consists of 5 minutes of stepping up and down on a bench at a rate of 90 steps per minute. Height of the bench is 15.75 inches for men and 13 inches for women. The step test is safe and easy to administer.

Many Disappointed

Most people taking the step test do not score well unless they lead physically active lives. Since the majority of people today—especially in the United States—lead sedentary lives, many of them are disappointed after taking the step test. The ones who receive the biggest shock, and experience the most disbelief, are the ones who consider themselves "active" hunters, fishermen, or golfers.

The real problem comes when your name is struck from the fire standby list and your "red card" is revoked, because you could not pass the fitness test. This is a blow to your pride; especially if you have considerable firefighting experience gained over a long period of time.

Some will take a positive attitude and ask, "What can I do to improve my fitness?" A few people, on the other hand, will take a negative view and criticize the testing procedure and the need for standards. They make excuses when really they are just in poor physical condition and refuse to admit it.

A Good Beginning

If you want to improve your physical condition, a complete self-evaluation of your fitness is a good beginning.

Ask yourself these questions:

- "Am I overweight, soft, flabby, and tired?" (If you weigh more than you did at age 21, you are probably too heavy.)
- "Do I feel older than I really am?"
- "Does a minimum amount of physical exertion, such as climbing a flight of stairs, make me gasp for breath, cause my heart to pound, and generally leave me in a weakened condition?"
- "Do I generally live a sedentary life?"

If you can recognize yourself from any of these, you are probably in less than good physical condition.

What is physical fitness? A good definition of physical fitness is the ability to carry out daily tasks with vigor and alertness without undue fatigue and to have ample energy to enjoy leisuretime pursuits and to meet unforeseen emergencies. The real indicator of fitness is endurance, or stamina, and not a strong muscular physique.

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James A. Dukes is the Fire Management Assistant on the Kisatchie National Forest in Pineville, La.

Wildfire Hazard Classification Mapping for Suburban Land Use Planning

James R. Getter

Colorado, with an area of 104,247 square miles, ranks as the ninth largest State in the United States. Elevations range from 3,200 feet on the plains to 14,433 feet in the mountains. Populations soared from 1.75 million to 2.2 million during the 1960's. Eighty percent of these people reside in the 13 counties along the eastern Front Range of the Rocky Mountains. Because of the rapid growth and development in Colorado, the State Forest Service (CSFS) has designed and implemented a wildfire hazard classification mapping program to assist county planners and local governments in the planning of mountain sub-divisions.

The base-map series used for this program is the nationally available U.S. Geological Survey 7.5-minute topograpich quadrangles at a scale of 1/24,000 with a contour interval of 10 feet in the plains and 40 feet in the mountains. Sixty-three percent of Colorado's 1,284 quadrangles are currently in print. Of these, 900 cover mountainous or forested areas.

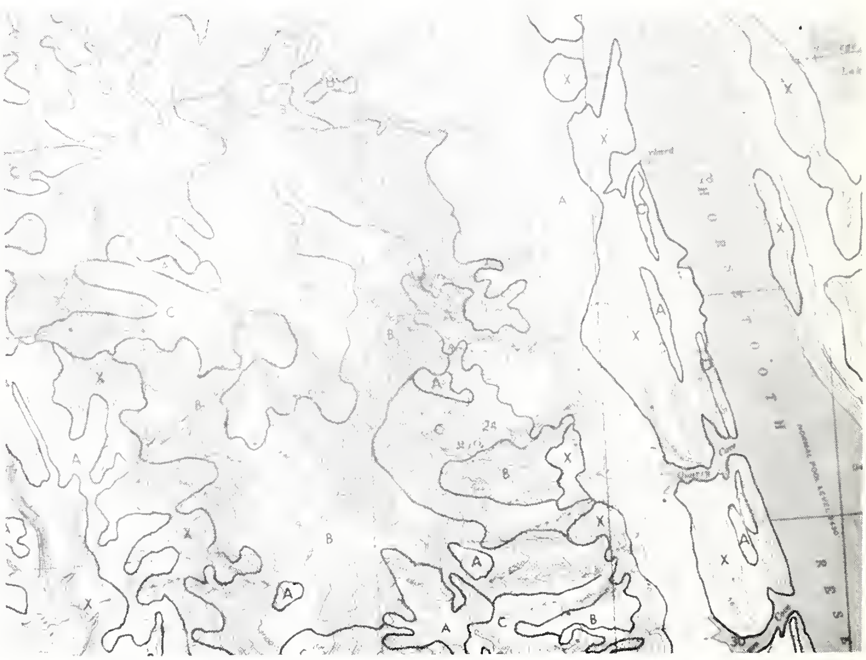
James R. Getter is an Assistant Staff Forester with the Colorado State Forest Service, Fort Collins, Colo. Mr. Getter is Project Leader of the Wildfire Hazard Classification Mapping Project.

Basic Mapping Procedures

Wildfire hazard classification mapping criteria include slope, aspect, vegetation density, and vegegation typing (Lynch 1974).

Slope, an important determinant of fire behavior, is divided into two classes: slopes under 30 percent and slopes 30 percent and over. A pair of preset dividers is used to measure distances between map contour lines. Slopes of 30 percent or more occur where two or more contour lines fall within this preset distance. These extreme-slope areas are then shown as shaded areas on overlays to the topographic maps, while those areas with slopes under 30 percent are left clear.

Aspect, for mapping purposes, is divided into eight 45-degree classes



Fire hazard classification information is put on reproducible mylar overlays and is used in conjunction with 7.5-minute USGS topographic maps. This map covers an area west of Fort Collins, Colo.

(N, NE, SE, S, SW, E, W, and NW) centered on true azimuth bearings. Primary emphasis is placed on south and southwest aspects for wildfire hazard mapping because of the increased solar radiation and varying vegetation types found on these aspects. These aspects are depicted on the maps in shaded blocks. The point aspect finder, developed by CSFS technicians (Frobig and Seger 1976), is used for fast, accurate determination of aspect classes.

Vegetation density data are visually interpreted from aerial photographs—either 9- by 9-inch black-and-white panchromatic contact prints at a scale of 1/20,000 or color infrared transparencies at a scale of 1/50,000. Fuel density and classification rating systems developed by Fahnestock (1971) for the CSFS are used in this project.

Vegetation typing is the final component of the fire hazard/ecosystem mapping package (Lynch 1974) and is shown on overlays to the topographic maps. Ecosystem identification consists of photointerpretation and ground verification of selected plant species that indicate particular ecosystems. Certain ecosystems are indicative of a particular hazard classification.

Field Checking

Field checking is the next process. One sample plot is randomly selected for each of the following: five fuel hazard classes, two slope classes, two aspect classes, and 18 ecosystems classes. Vantage points which view larger areas are used whenever possible. Incorporating field-check corrections and producing the overlays are the final processes.

Because of the time-consuming job of delineating slope and aspect, the CSFS has developed a computerized mapping system known as TOPOMAP (Tom and Getter 1975). This program is largely based on the TOPOGO computer program of Sharpnack and Akin (1969) which is used to compute slope and aspect from a uniform network of elevation values. CSFS is also working with satellite imagery and ecosystem mapping in the mountainous areas of Colorado.

The Results

The mapping criteria are finally displayed on reproducible mylar overlays. These are given to local governments by the State district foresters with an explanation of their derivation, use, and application to land use planning and decisionmaking. Technical assistance is also provided to local governments, State agencies, citizens, and private industry by State district foresters.

These overlays and the information they contain, along with the technical assistance given by the district foresters, provide an important link in the land use planning and decisionmaking process. The results are better and more meaningful land use plans in Colorado.

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PHYSICAL FITNESS

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To be physically fit, the body must have a strong, efficient cardiovascular system. It must be able to take in, transport, and utilize oxygen to provide energy to the heart, brain, lungs, and muscles. Body fuels, in the form of food, are plentiful. A person can eat and drink as much as he wishes. Oxygen is likewise plentiful; however, not all the oxygen taken into the lungs is used. Physically fit bodies utilize a greater percentage of the inhaled oxygen than physically unfit bodies.

Body Like A Machine

The human body is like a machine, but with one big difference. Most machines deteriorate with use, but the human body deteriorates with *non-use*. If you don't believe this, recall what a fractured arm or leg looks like after the cast is removed, or how you feel when you first get out of bed following an illness.

Physical deterioration shows in many forms. It is indicated by an accumulation of fat, especially in the stomach area; a decrease in cardiovascular and cardiorespiratory efficiency; slowed reaction time; loss of flexibility of the muscles and joints, especially in the lower back; loss of balance; loss of muscular strength and endurance.

Physical deterioration keeps you from operating at your best, makes you accident prone, and makes you susceptible to all kinds of minor ailments—such as low back pain and knee problems. It is a serious health hazard!

Fortunately, physical deterioration can be reversed through exercise. The case for exercise has been well established over the years. Light activity, such as a daily 1-mile walk, reduces the risk of heart attack approximately 30 percent.

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Motivation Important

If you decide to improve your physical fitness, you must first develop the inner motivation to exercise. It will not be easy, but the payoffs far exceed the effort involved.

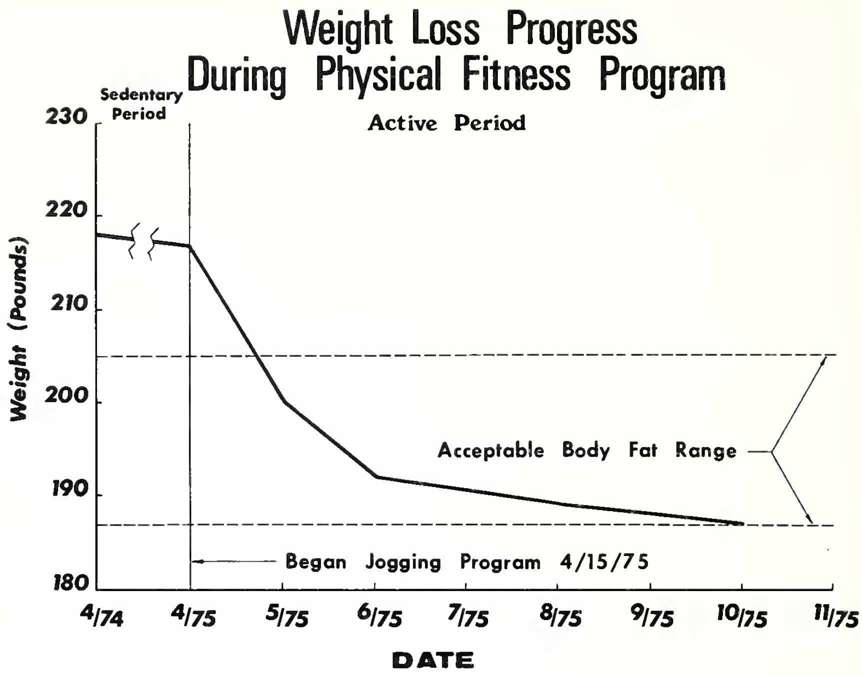
Learn to give yourself the step test, so you can test yourself periodically to monitor progress. First, determine you present level of fitness using either the step test or one of the methods described by Cooper (1970). Then analyze your eating habits and caloric intake, especially if you have weight to lose. When you have done this, select an exercise program that best fits you.

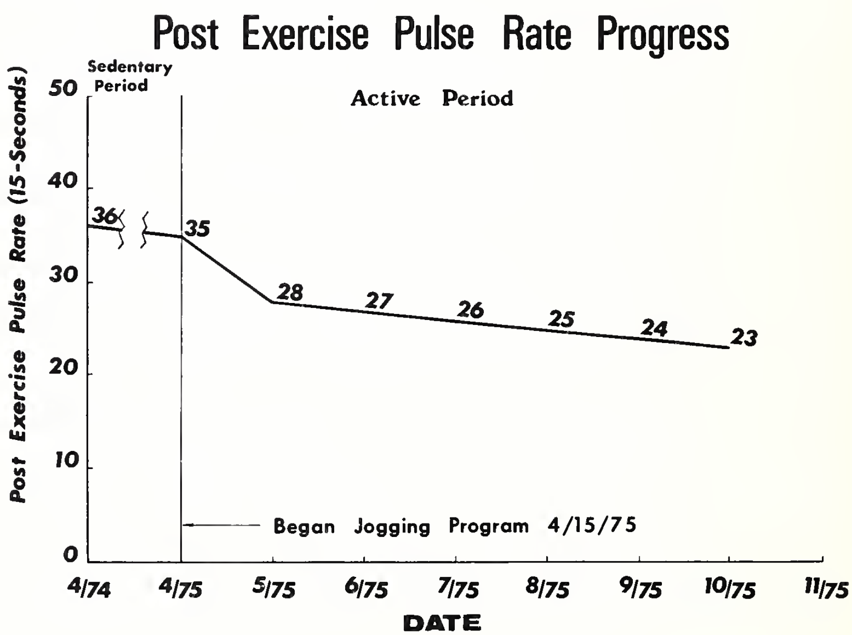
Personal Experiences

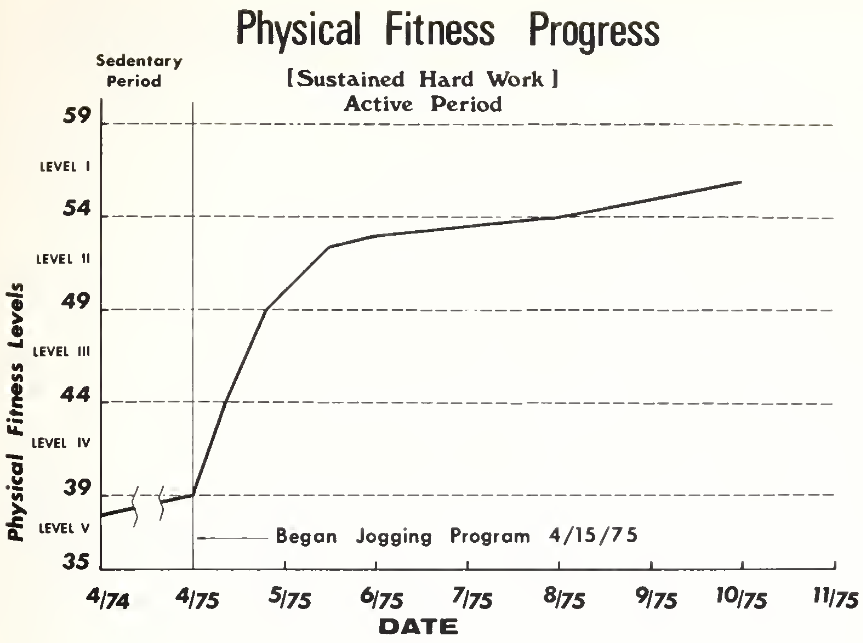
I will use my own personal experiences to illustrate what can be done. In April 1974, I scored 37 on the step test (37 milliliters of oxygen/kg of body weight) for a fitness Category V, which is considered poor. A year later, I took the test and scored 39, still at Category V. I then decided to do something about my physical condition.

I started a jogging program, slowly at first, alternating between running and walking for 15 minutes per day, gradually working up to 8 to 10 miles per week. I reduced my caloric intake by about 1200 calories per day.

Soon I began supplementing jogging with badminton, rope skipping, and other activities and was burning 1800 to 2000 calories per day in exercise (10,200 to 10,400 calories per week). Since it takes 3500 calories to make a pound of fat, I should have lost 3 pounds of fat per week. Actually, weight loss was about 4 pounds per week, probably due to my increased capacity for exercise that occurred after the first couple of weeks. Correspondingly, by the end of 5 months, my fitness level had increased steadily, from Category V (poor) to Category I (superior). I







lost 40 pounds and 4 inches in the waist during the period. My post-exercise pulse rate decreased from 140 beats per minute to 92 beats per minute. All this was accomplished by spending an average of 30 minutes per day exercising, which was no great sacrifice for me.

My jogging program gradually increased to 2 to 3 miles per day (10 to 12 miles per week). Most of my diet restrictions were discontinued after 4 months. It was obvious, however, that my eating habits had been reshaped. The exercise of the program had eliminated a bad knee problem, a nagging back pain, and improved my ability to sleep soundly.

Don't Give Up

If you are not now in good physical condition, don't give up! You can do something about it. Find out what your present physical condition is. Decide what fitness goals you want to reach. Have your doctor give you a physical examination, preferably with a stress electrocardiogram. Start slowly, keep it moderate, but stick to it. You'll be amazed at the changes that will occur. Improved fitness seems to enhance body image and self concept. It can add "life to one's years" as well as "years to one's life."

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FIRE MANAGEMENT

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Predicting Weights of Douglas-fir Slash for Material up to 3 Inches in Diameter

Paul M. Woodard,
Stewart G. Pickford, and
Robert E. Martin

One of the byproducts of any logging or silvicultural operation is the residue or "slash" remaining after the merchantable material is removed. This slash can cause problems with timber regeneration, wildlife and domestic animal utilization of the area, esthetics, and especially fire control. Although techniques exist to determine the amount of this material once it has been created, forest managers should have some means of predicting the amount of slash resulting from any planned harvest of thinning operation well in advance of that operation. This problem is of particular concern on the western slope of the Cascade Range, in Douglas-fir stands.

Douglas-fir slash can be subdivided into two categories: (1) bole material not removed because of defect or breakage; and (2) bole and branch material too small to be utilized, consisting of the upper unused portion of the bole, the limbs and branches, and the attached foliage. The results reported here deal with this smaller material (less than 3-inch diameter) which is of particular concern as "flash" fuels in logged or thinned Douglas-fir stands. Predicting volumes of larger material on Douglas-fir clearcuts is the subject of a separate study to be reported soon.

The purpose of the work we report here was to sample the crowns of various-sized Douglas-fir along its range in western Oregon and Washington. This information was then combined with other published data to arrive at a predictive equation of Douglas-fir crown material that ultimately ends up as slash of less than 3-inch diameter.

Eight dominant or codominant trees varying from 3.5- to 43.7- inch d.b.h. were sampled. Two were sampled near Eatonville, Wash., at the University of Washington Experimental Forest; five trees at the Wind River Ranger District, Gifford Pinchot National Forest, about 5 miles north of Carson, Wash.; and one tree on the Detroit Ranger District of the Willamette National Forest. Except for a small 4-inch d.b.h. tree, dead branch material was removed and collected before felling. After felling, the live crown was divided into thirds along its length and subsampled to determine the foliage-to-twig ratio (Woodard 1974). Foliage weights were then estimated, using this ratio and the measured weights of twigs in the 0- to ¼-inch size class. Branches were separated and weighed into 0- to ¼, ¼- to 1-, and 1- to 3-inch size classes. Samples were taken for moisture content determination, so results could be expressed as ovendry weight.

Data Used

Similar work (Storey et al. 1955, Chandler 1960, Fahnestock 1960) provided baseline information on expected crown weight values for Douglas-fir. Fahnestock's data, along with biomass research in Douglas-fir stands (Dice 1970, Heilman 1961, Swank 1960) and the measurements we made, were used to estimate crown weights for material less than 3 inches in diameter.

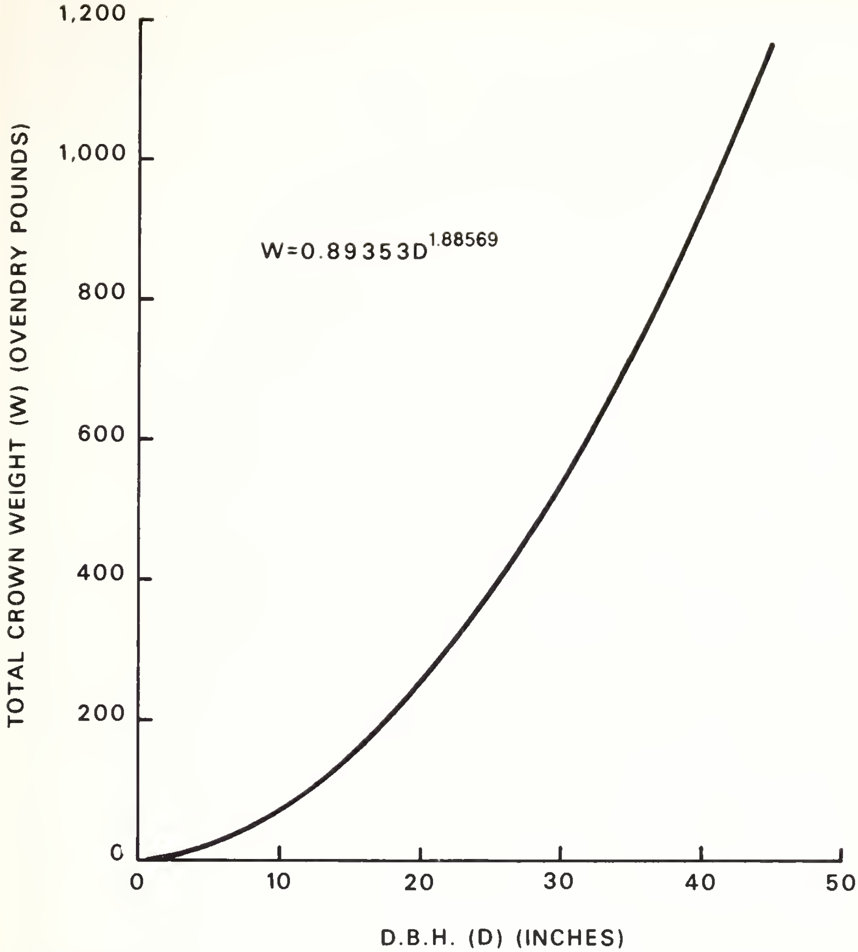
Results

The two largest trees were eliminated from the regression analysis due to incomplete information. The data from the remaining six trees were combined with data gathered by Dice (1970), Heilman (1961), and Swank (1960) to provide the following regression equation:

$$\text{total ovendry crown weight (lb)} = 0.89353\text{Dbh}^{1.88569}\ (\text{in}).$$

Attempts to correlate d.b.h. with the proportion of branchwood in each of the three size classes failed. The sample size for this correlation was limited to eight trees because Dice, Heilman, and Swank did not stratify branchwood into size classes.

Paul M. Woodard is a Research Assistant in the College of Forest Resources of the University of Washington, Seattle, Wash. Steward G. Pickford is a Research Forester at the U.S. Department of Agriculture, Forest Service Pacific Northwest Forest and Range Experiment Station in Seattle. Robert E. Martin is Project Leader at the Pacific Northwest Forest and Range Experiment Station and is stationed in Bend, Oregon.



Total ovendry weight of crown material less than 3-inch diameter for Douglas-fir of various diameters.

However, the proportions of total crown weight represented by needles, live branches, and dead branches were:

needles: live branches:
dead branches = 0.35:0.40:0.25

This proportion was essentially constant over the range of diameters sampled, a feature also observed by others (Baker 1962, Metz and Wells 1965, Ovington 1957, Ovington and Madgwick 1959).

Application

We have assumed that, as a minimum, the land manager will have an estimate of the numbers of Douglas-fir stems by 1-inch diameter class for any unit to be treated silviculturally. Then, to find the total ovendry weight of slash less than 3 inches in diameter expected to be on a unit:

(1) Find the crown weight per tree for each 1-inch diameter class to be felled in the operation.

(2) Multiply the weights by the number of stems in the respective diameter classes to be felled.

(3) Add the total weight for each stem class to find the total ovendry weight.

Once the total weight is found, the proportions of needles-to-live-to-dead-branches can be applied to give an idea of the character of the slash. This knowledge, especially the weight of the needles, is useful since the needles will drop to the ground if the slash is allowed to overwinter or is treated after it has been well cured, giving a resultant reduction in slash weight up to about 35 percent, as well as reduced flammability.

Conclusion

This study was an attempt to collect existing information into a useful tool for managers in the Douglas-fir region of the Pacific Northwest. Other research is underway to provide more precise predictors of slash weight, but in the meantime, this work should serve as a useful first approximation for material up to 3 inches in diameter. One observation made in the course of this work was that Fahnestock (1960), who sampled healthy dominant and codominant Douglas-fir in the Intermountain Region, found almost the same weights of live foliage and live branchwood as those recorded for trees of similar diameter in the Douglas-fir region. This suggests that models for predicting small-sized slash which was developed for Douglas-fir in one Region may be applicable to other Regions where this species occurs.

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Equipment Development Reporting

Arthur H. Jukkala

Many of you are familiar with equipment development publications such as *Equip Tips* (see listing in the Fall 1975 issue of FIRE MANAGEMENT), Equipment Development and Test (ED&T) Reports, and the annual report on the equipment development and test program. But much fire-related ED&T work appears in unpublished reports that have limited distribution.

These unpublished reports are project records and special reports. Because so much fire management equipment development work is described in these reports, and because so few field personnel get to read them, we felt some information about them would be of interest.

Project records essentially are progress reports. They are usually scheduled at some significant milepost in an ED&T project. Most projects are covered by at least one project record. Others may have as many as six. The Equipment Development Center will often incorporate conclusions and recommendation in unpublished project records. The unit or staff group which is sponsoring and funding the particular project may not always agree with these conclusions or recommendations. The reader, therefore, must keep in mind that these parts of the project records may not necessarily reflect national policy or direction.

Special reports usually focus on single topics and do not deal with the progress in a specific project.

Listed below are unpublished reports written in the past 3 fiscal years which are available in limited supplies:

An Operational System for Constructing Fireline with Explosives	June 1975
Firefighters' Exposure to Carbon Monoxide on the Deadline and Outlaw Fires	May 1975
Investigation of the Need and Feasibility of Improving Ground Detectors	September 1974
Weathermeasure Corporation Model WS750 Automatic Weather Station	August 1974
Fuel Treatment Systems for Partially Cut Stand	August 1974
A Field Evaluation—Helicopter Mounted Grenade Dispenser and Incendiary Grenades	August 1974
Linear Fireline Explosive System	July 1974
Firefighters Physiological Study	June 1974
Fire Surveillance Systems	June 1974
Fire Weather Stations	June 1974
Firing and Line Holding Devices	June 1974
Fire Detection Systems for Seed Orchards or Small High Value Areas	May 1974
Annual Analysis—Smokejumper Injuries and Parachute Malfunctions CY 1973	(undated)
Survival Kit for Aircraft Personnel	November 1973
Flail Trencher Tests	July 1973
Development of Dry "Nonincendive" Linear Charge for Fireline Construction	July 1973
Annual Analysis—Smokejumper Injuries and Parachute Malfunction CY 1972	(undated)
Comparative Evaluation, Region 8 Fireplow and the MEDC Flail Trencher on the Modoc National Forest	April 1973
Expendable Wash Kit	April 1973
High-Volume Retardant Sprayer	February 1973
M-79 Grenade Launcher	February 1973
Portable Latrines for Fire Camp Use	February 1973
Service Test of DHC-4A Caribou Aircraft for Smokejumping	February 1973
Kapton Fire Escape Hood	January 1973
Handthrown Incediary Grenades	October 1972

Arthur H. Jukkala is a Forester at the Missoula Equipment Development Center, Forest Service, U.S. Department of Agriculture, Missoula, Mont.

National Advanced Fire Prevention Training

R. L. Newcomb

Multiagency cooperation in fire prevention planning was the keynote at the National Advanced Fire Prevention session conducted at the National Fire Training Center, February 2–13, 1976.

Fire prevention leaders from throughout the United States and Canada attended. Participants represented private industry (a first for one of these sessions), Bureau of Land Management, Forest Service, Bureau of Indian Affairs, State Forestry and Fire Control, National Park Service, city and county fire departments, and the provinces of Manitoba and Ontario, Canada. Team assignments were made on a regional basis. Teams represented the Northeast, Southwest, Southeast, California, Northwest, Intermountain area, and Alaska.

The Objective

The objective of the National Advanced Fire Prevention Course was to have the teams prepare written action plans for efficient multiagency fire prevention for their home areas and provide for a continuous team-action approach following completion of the course.

During the first week, the participants received 40 hours of instruction relating to the concepts of fire prevention which provided a better understanding of the Smokey Bear Campaign, data systems and information recovery techniques, research, fuel modification, fire danger ratings, communication skills, and law enforcement. There was also time for the exchange of ideas and fire prevention techniques. By the end of the week, each participant took part in at least 17 instruction periods.

New Working Tools

New working tools—Planning and Problem-Solving Models—were introduced to the teams at the beginning of the second week. Presented by specialists from the Harless Performance Guild, the models provided a means of identifying solutions to the problems encountered in planning fire prevention programs.

In the concluding days of the session, the participants, armed with newly learned fire prevention techniques and a new means of solving problems encountered along the way, rolled up their sleeves and went to work drafting fire prevention action plans.

A lack of time and a lack of representation from some of the affected agencies prevented the completion of final action plans for each regional area, but skeletal plans were prepared. In a wrap-up session, each team displayed and explained their progress and success in developing the action plan. They also gave special attention to explaining how the planning effort would be continued following the workshop.

Continued on next page

National Advanced Fire Prevention training session instructors come from Federal, State, and private sectors. Here Leo Wilson, of the Oregon State Department of Forestry, presents a class on the use of restrictions in fire prevention.

R. L. Newcomb is the Resource Assistant, Boise Ranger District, Boise National Forest in Boise, Idaho.

PREDICTING WEIGHTS

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PREVENTION TRAINING

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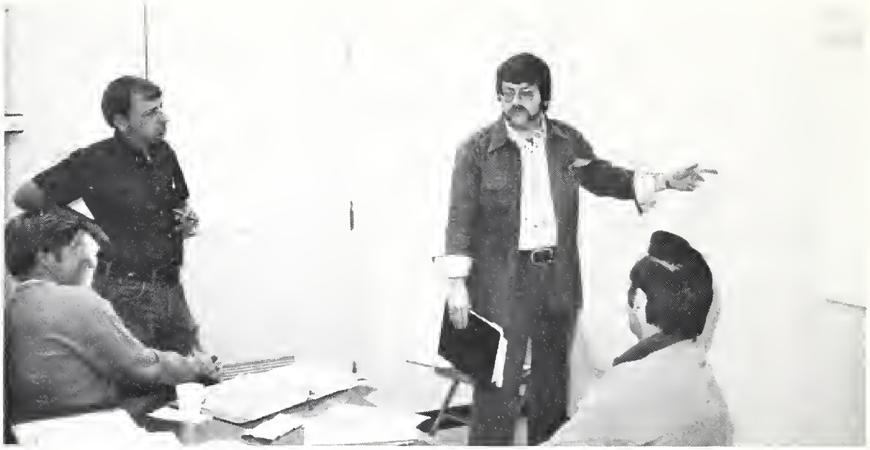


Planning and problem-solving models were introduced to the teams by specialists from the Harless Performance Guild. This team was made up of representatives of the Forest Service Washington Office, Nevada State Office of the Bureau of Land Management, and Ministry of Natural Resources of Ontario Province.

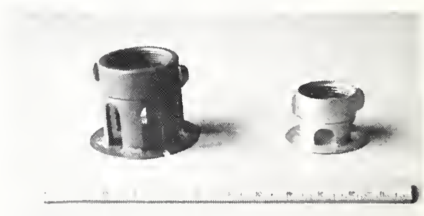
The multiagency approach to fire prevention planning was considered a success by those who shared in the training. Faced with increasing suppression costs and intolerable consequences of a conflagration, agencies will be able to utilize this process to achieve realistic goals in reducing man-caused wildfire starts and also in reducing the consequences of both man-caused and lightning-caused wildfires.

Tank-Filler Hose Holder

One man can now fill a water tanker as easily and as quickly as two men once did. The Northern Region of the Forest Service has designed and constructed a holder for tank-filler hoses. The holder keeps the hose in the water tank which is being filled. Constructed of an old hose coupling and an electrical junction box cover, the holder can be screwed onto a water hose and then lowered into the tank. When the operator starts the pump, he can be assured that the hose will not forcibly eject itself from the tank when the water flows through the hose under pressure.

When the surge of water hits the baffle plate in the tank, the water is ejected sideways through several side openings in the fitting. This eliminates the normal kickback that occurs when water flows straight out of the hose. Holders can be made for any size of hose—from 1 inch to 6 inches or even larger.

Drawings can be obtained by writing to the Director of Fire and Aviation Management, Northern Region, Forest Service, U.S. Department of Agriculture, Federal Building, Missoula, Mont. 59801.



Holders can be made for any hose size.

Precipitation Duration Meter

Stanton R. Withrow

A simple, but workable instrument for obtaining precipitation duration has been devised by Daniel W. Barnes, Communications Equipment Technician for the Perry District of the Florida Division of Forestry, Department of Agriculture and Consumer Services.

Precipitation duration is an important element of Florida's fire danger rating system. Weather observations are made by the dispatcher, but it is difficult for a busy dispatcher to note precisely when rain begins or ends. Precipitation which begins or ends at night is particularly subject to large estimation error. The meter designed by Barnes works equally well night or day and is accurate in most cases to within a few minutes.

Sensor, Control, and Clock

The precipitation duration meter consists of three parts—a sensor, a control, and a clock.

The sensor consists of two small strips of metal housed in a cylinder 12 inches in height and 5 inches in diameter. A plastic funnel, seated in the cylinder, collects the rainfall and funnels it onto the sensor. The moisture completes an electrical circuit to the control, thus starting the clock. A 12-volt incandescent lamp (an automobile headlight) mounted in the cylinder dries the moisture so

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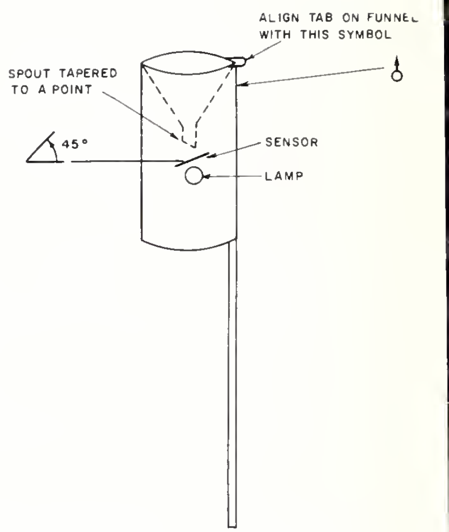
Stanton R. Withrow is Meteorologist with the Fire Control Bureau of the Florida Division of Forestry in Tallahassee, Fla.

SENSOR



that the clock is stopped when rainfall ceases. The lamp, which burns continuously, also keeps dew and fog from triggering the clock and giving false readings.

The control is generally located in the dispatcher's office near the clock and an alternating-current power source. A delayed-release switch in the control prevents the mechanism from "chattering." An ordinary electric clock is plugged directly into the control and is set at 12 o'clock at the beginning of an observation period. Precipitation duration is read in hours and minutes up to a maximum duration of 12 hours.

Final adjustments are made by Dan Barnes, the designer of the precipitation duration meter.

Location Important

Like any precipitation recording device, the precipitation duration meter should be located in an open area away from buildings and trees. There should be no obstruction 45 degrees above the horizon in a full circle around the meter.

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A Fire Potential Assessment Model for Brush and Grass Fuels

Randall J. Van Gelder

A computer model is now available for chaparral and grass fuels which provides fire managers with generalized fire-spread information within minutes of the report of a fire. The model provides an estimate of the forward and lateral spread of a fire for given fuel and weather conditions over uniform slopes.

The model has been used by Regional coordinators to help assess the relative potential of multiple fires occurring on the same day. Based on fire weather predictions for each day, the model was run to provide a Regionwide analysis of potential problem areas which could develop into situations requiring extra-Regional resources. As data became available for specific fires, the model was run with those specific conditions in an attempt to provide partial validation of the modeling concept. The model is accessible to anyone with a valid General Electric Timesharing account number and a terminal similiar to the ones used for the National Fire Danger Rating AFFIRMS system.

Randall J. Van Gelder is an Operations Research Analyst at the Pacific Southwest Forest and Range Experiment Station Forest Service, U.S. Department of Agriculture, Berkeley, Calif. He is stationed at Riverside, Calif.

The Model

The model is based on the assumption that a fire spreading on a uniform slope and burning in uniform fuels can be adequately represented by an ellipse with the length-to-width ratio determined by the slope, windspeed, and fuel characteristics. Basic rate-of-spread predictions for the brush and grass fuel models are calculated using slight modifications of the equations developed by Rothermel (1972) and Rothermel and Philpot (1973). The rates of spread in forward and lateral directions are combined to estimate an elliptical shape for a 1-hour burning period. Additionally, estimates of the size in acres and of the perimeter in chains are calculated and displayed for the user. Successive burning period predictions can easily be combined graphically to show spread patterns over a longer burning period.

The computer program requires the following inputs to be specified by the operator:

- Type of fuel (brush, grass)
- Slope percent (average for fire location)
- Age of fuel (years)
- Fine fuel moisture (1-hour timelag)
- Windspeed (average in mi/h)
- The month in which the fire is burning
- Day of the month

Fuel type, age, and date are used to describe the condition of the fuel at the time of the fire. In addition, slope and windspeed are required for calculation of the basic rates of spread and the shape of the fire.

The program is accessed by using the LINK command of the AFFIRMS system, i.e., LINK FIREMOD (Helfman et al 1975). The program then instructs the operator on how to enter the required information.

The model was used extensively by the FIRESCOPE Operations Coordination Center during the 1975 fire season for both assessing the fire potential for a given day (based on National Weather Service predictions) and for individual fires as data became available. The data from morning weather forecasts for 16 stations were used for selected fuel combinations and slopes in specific geographical locations in southern California to provide an estimate of the fire potential for the area. The predicted rates of spread and size estimates provided a quantitative refinement to the currently available National Fire Danger Rating System by providing actual estimates of rates of spread and fire sizes.

Two examples of the model's capabilities and use are presented below. The type of output described can be available shortly after the report of a fire, and thus may be of

value to dispatchers in making decisions before qualified fire personnel actually arrive at the fire site.

Palm Fire

The model was run for the Palm Fire which occurred in the San Bernardino National Forest on September 25, 1975. The model-predicted size after 6 hours was 404 acres while the actual fire size after 6 hours was 775 acres.

Figure 1 graphically demonstrates the utility of the model. The solid line represents the actual perimeter as determined by interpreting the linescan imagery from an infrared mapping unit. The shaded area represents the 6-hour cumulative prediction from the model. While the model cannot take suppression action into account, the overall results are sufficient for general planning purposes, especially at the General Headquarters or Regional coordination level.

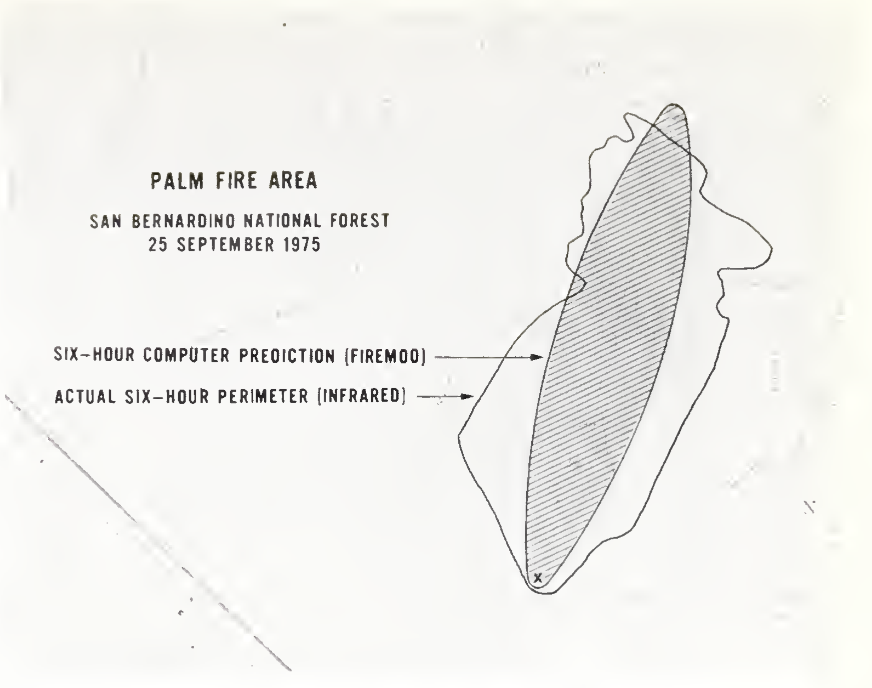

Figure 1.—Graphical representation of computer prediction versus actual size for the Palm Fire.

Indian Fire

On May 29, 1976, a fire occurred on the Monterey District of the Los Padres National Forest. Based on the predicted fire danger, the burning conditions were classed as moderate on May 29. The model, however, predicted that a fire burning under these conditions would, in fact, burn quite rapidly (166 feet per minute). The fire management officer estimated the fire had burned 750 acres in the first 1½ hours after its origin. The model prediction for this same burning time was 712 acres. This prediction, if it had been available, could have given an early warning to fire specialists that this fire might not be simple to handle.

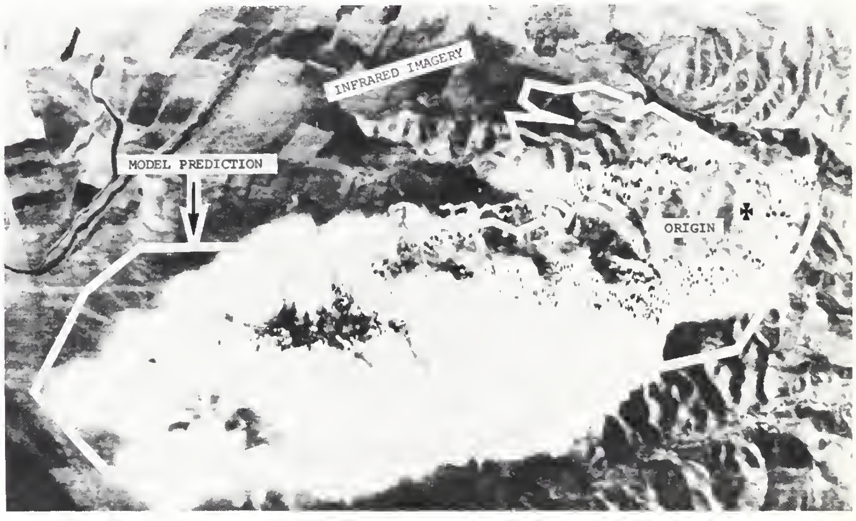

Figure 2.—"Second generation" model prediction overlayed onto infrared imagery for the Potrero Fire, September 26, 1973.

Continuing Research

While these data are not sufficient to completely validate the model, they are sufficient to suggest its use as an aid in the rapid evaluation of fire potential using a minimum of input information. Additionally, these results suggest the utility of continued development and application of the models. The extension of the elliptical model to other than brush and grass types requires the formulation of fuel models and specification of the fuel parameters described by Rothermel (1972), and analysis to insure that an elliptical representation is sufficient for the fuels in question. The FIRESCOPE Research Work Unit at the Riverside Fire Laboratory currently is developing a substantially more complex model for the prediction of large fire spread patterns. This "second-generation"

Continued on next page

FIRE POTENTIAL ASSESSMENT MODEL

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model, when complete, will require an inventory of fuels, topography, cultural features, and water facilities, at approximately one acre resolution, as data base for its operation. Figure 2 shows a preliminary run of the model on the Potrero Fire which burned in brush and grass fuels in Ventura County, Calif. in 1973.

This model incorporates a simple learning mechanism which allows the model predictions to be updated as actual fire perimeter information is gathered during the fire. Although the models are being developed for southern California, the model structure is adaptable to other geographical areas.

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PRECITATION DURATION METER

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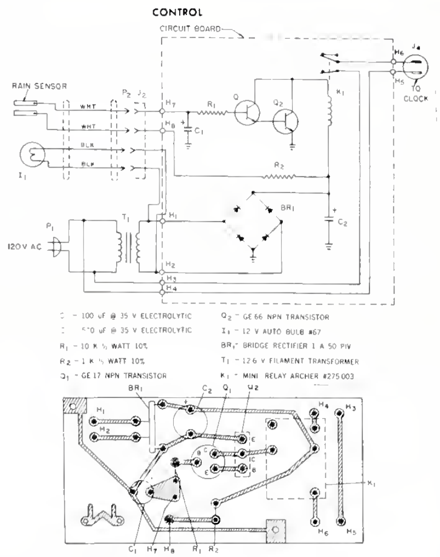

FOIL SIDE

The meter must be checked periodically to insure that the lamp is on. Burned out lamps must be replaced as soon as possible for the meter to continue to give accurate readings.

The meter has been tested for several months at the Perry District office and has given reliable results during the test period. Occasionally, the meter has not been triggered during a very light rainfall. In each of these cases only a trace of moisture was recorded.

Precipitation duration meters have been installed at 13 other district offices and in three National Forests in Florida. They have proved their worth by providing accurate information which is very important to the determination of fire danger.

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